Ecological and distributional notes on hummingbirds from Bolivian lowland forests

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SUMMARY.—Little is known about the distribution, ecology and behaviour of hummingbirds in the Andean foothills of Bolivia, where many lowland hummingbird species reach their south-western distributional limits. In November 2007–October 2008, we surveyed hummingbirds at six sites along a 660-km transect, from tropical Amazonian humid forest to subtropical spiny forest of the Gran Chaco. In total, we found 21 hummingbird species. For ten of these, we provide new information on latitudinal and elevational movements, feeding or breeding behaviour. In particular, we provide evidence for seasonal movements of five species, including such widespread taxa as White-chinned Sapphire *Hylocharis cyanus* and Fork-tailed Woodnymph *Thalurania furcata*, which are considered sedentary throughout most of their ranges, but which appear to undergo seasonal movements at their range limits in Bolivia.

Little is known concerning the distribution, ecology, and behaviour of hummingbirds in the Andean foothills of Bolivia, where many lowland hummingbird species reach their south-west distributional limits (Schuchmann 1999). Between November 2007 and October 2008, SA surveyed hummingbirds at six sites along a 660-km transect from tropical Amazonian humid forest to subtropical spiny forest of the Gran Chaco during the rainy and dry seasons. From north to south, our study was conducted at Villa Tunari, dpto. Cochabamba (16°57′S, 65°24′W; 400 m), Sacta, dpto. Cochabamba (17°06′S, 64°47′W; 204 m), Buena Vista, dpto. Santa Cruz (17°30′S, 63°38′W; 424 m), Santa Cruz, dpto. Santa Cruz (17°46′S, 63°04′W; 397 m), Río Seco, dpto. Santa Cruz (18°42′S, 63°11′W; 434 m), and Corbalán, dpto. Tarija (21°36′S, 62°27′W; 268 m). Along this transect, mean annual precipitation decreases, from 6,258 mm at Villa Tunari to 410 mm at Corbalán, whilst seasonality in temperature and precipitation increases (Kessler *et al.* 2007). The survey sites consisted of primary and occasionally slightly disturbed forest. Each locality was visited twice for 16 days, once during the dry season (May–October) and once during the rainy season (November–April). Hummingbird species, their activity and the plant species visited were noted. Additionally, hummingbird observations were made en route to and from the study sites. Because hummingbirds are difficult to count, species abundance was grouped by three categories: 1–3 per visit (uncommon), 4–9 per visit (common), and >10 per visit (very common). Species identifications were made by SA using Erize *et al.* (2006).

In total, we found 21 hummingbird species (Table 1). For ten of these, we provide new information on latitudinal and elevational movements, feeding or breeding behaviour. In particular, we provide evidence for seasonal movements by five species, including the widespread White-chinned Sapphire *Hylocharis cyanus* and Fork-tailed Woodnymph *Thalurania furcata*, which are considered sedentary throughout most of their ranges (Schuchmann 1999), but which appear to undergo seasonal movements at their range limits in Bolivia.

TABLE 1
Hummingbird diversity and abundance of the study sites during the rainy season (R) and dry season (D); 1 = uncommon, 2 = common, 3 = very common.

	Corbalán (R)	Corbalán (D)	Río Seco (R)	Río Seco (D)	Santa Cruz (R)	Santa Cruz (D)	Buena Vista (R)	Buena Vista (D)	Sacta (R)	Sacta (D)	Villa Tunari (R)	Villa Tunari (D)
White-bellied Hummingbird *Amazilia chinogaster*				1						1		
Glittering-throated Emerald *Amazilia fimbriata*									1			
Black-throated Mango *Anthracothorax nigricollis*								2				
Grey-breasted Sabrewing *Campylopterus largipennis*			1				3		3			2
White-bellied Woodstar *Chaetocerus mulsantii*							1					
Glittering-bellied Emerald *Chlorostilbon aureoventris*	1	3		3	1							
Collared Inca *Coeligena torquata*									1			
White-necked Jacobin *Florisuga mellivora*							1		1			
Rufous-breasted Hermit *Glaucis hirsutus*									1		1	
Violet-fronted Brilliant *Heliodoxa leadbeateri*							1					
Blue-tufted Starthroat *Heliomaster furcifer*	1	1										
Gilded Sapphire *Hylocharis chrysura*			3	3	3	2						
White-chinned Sapphire *Hylocharis cyanus*			1				2	2		2		
Rufus-crested Coquette *Lophornis delattrei*										1		
White-bearded Hermit *Phaethornis hispidus*							1					
Great-billed Hermit *Phaethornis malaris*									3	2	2	2
Reddish Hermit *Phaethornis ruber*									2	2	2	2
White-browed Hermit *Phaethornis stuarti*							2	2				
Buff-bellied Hermit *Phaethornis subochraceus*					2	2	3	3				
Fork-tailed Woodnymph *Thalurania furcata*	3	1					3	3	1	3	2	3
Pale-tailed Barthroat *Threnetes leucurus*											1	

GREY-BREASTED SABREWING *Campylopterus largipennis*

C. largipennis was very common at Sacta and Buena Vista during the rainy season in November and December 2007, when *Heliconia episcopalis* (Heliconiaceae), *Palicourea lasiantha* (Rubiaceae) and *Erythrochiton fallax* (Rutaceae) were flowering en masse, but during the dry season in August / September it was not observed at either site. At Villa Tunari, it was not recorded in May 2008 but was fairly common in July 2008 when *Passiflora coccinea* (Passifloraceae) was flowering. Similar seasonal shifts in the abundance of *C. largipennis* have been observed in Amacayacu National Park, Colombia, where the species is present only during the main flowering period of the common understorey shrub *Palicourea crocea* (Rubiaceae) (Cotton 2007). Apparently, this comparatively large hummingbird conducts regional movements and only occurs at a given locality when large numbers of suitable flowers are available in the understorey.

On 18 February 2008, SA observed a single *C. largipennis* at Río Seco, *c.*100 km south of the usual south-west range limit (http://www.natureserve.org/infonatura/). This suggests that movements might not only be local.

A nest of *C. largipennis* was observed at Sacta on 21–24 November 2007. It was located in a small tree, *c.*1.5 m above the ground, in primary tropical rainforest next to a small path. It was cup-shaped, constructed of plant fibres, covered with mosses and lichens, and contained two white eggs. In Brazil, *C. largipennis* breeds in June (Schuchmann 1999). Next to the nest SA observed *Campylopterus* drinking water dripping from a hole in a tree in flight.

GLITTERING-BELLIED EMERALD *Chlorostilbon aureoventris*
This species showed strong seasonal variation in relative abundance at several localities. At Corbalán, it was very rare in January 2008 but very common in late May 2008 when it mostly fed on *Tripodanthus acutifolius*, a hemiparasitic Loranthaceae that was flowering in large numbers. At Río Seco, *C. aureoventris* was not observed during the rainy season (February 2008), but was common during the dry season in June 2008, when *Anisacanthus boliviensis* (Acanthaceae) was flowering. In the city of Santa Cruz, *C. aureoventris* visited some parks during the end of the wet season in April when *Chorisia insignis* (Malvaceae) was blooming in large numbers. Thereafter it was not observed again.

Breeding of *C. aureoventris* was observed in Corbalán during the early dry season at the end of May 2008. SA found a nest constructed of plant fibres attached to a piece of metal under the roof of the research station, *c.*2 m above ground. The year before, a similar site in an adjacent building was used for nesting (pers. comm. of the local ranger). In Brazil, *C. aureoventris* breeds in September–November (Oniki & Antunes 1998).

COLLARED INCA *Coeligena torquata*
SA observed a male feeding on flowers of *Calathea* sp. (Maranthaceae) at Sacta on 17 November 2007. *C. torquata* is a typical Andean species, which normally occurs from 1,500 m and higher (Schuchmann 1999, Hennessey *et al.* 2003). During the following night, a front of low air pressure arrived from the south, which reduced temperatures by *c.*10°C. Possibly, the downslope movement of this *C. torquata* was related to the cold front, as hummingbirds are well known to move elevationally in response to adverse weather (Hobson *et al.* 2003).

VIOLET-FRONTED BRILLIANT *Heliodoxa leadbeateri*
A female was observed on 20 December 2007 feeding on *Erythrochiton fallax* (Rutaceae) at Buena Vista (424 m). Normally, this species occurs above 800 m in Bolivia (Hennessey *et al.* 2003).

GILDED SAPPHIRE *Hylocharis chrysura*
Very common during the late wet and early dry seasons (April–July 2008) in the city and Botanical Garden of Santa Cruz. At the end of the dry season (September–October 2008) it was not observed in the city and was much less common in the Botanical Garden, even though suitable flowers were abundant in city gardens. This is indicative of some regional movements, which also are known from Brazil (Schuchmann 1999). In city gardens, *H. chrysura* often fed on *Malvaviscus arboreus* (Malvaceae) by laterally piercing the flowers.

WHITE-CHINNED SAPPHIRE *Hylocharis cyanus*
During the dry season in September 2008, this species was observed several times at Sacta, feeding on *Lantana* sp. (Verbenaceae) and *Leonotis leonurus* (Lamiaceae). During the wet season, it was not recorded at Sacta. Additionally, it was seen once during the wet season (February 2008) at Río Seco. These observations suggest that *H. cyanus* undertakes regional movements, which were previously unknown for this species (Hennessey *et al.* 2003).

RUFOUS-CRESTED COQUETTE *Lophornis delattrei*
A male was seen several times feeding on *Lantana* sp. (Verbenaceae) at Sacta in September 2008. This uncommon species otherwise is known in Bolivia only from records above 300 m elevation (Hennessey *et al.* 2003).

WHITE-BROWED HERMIT *Phaethornis stuarti*
This little-known species, one of the smallest hermits (Schuchmann 1999), was only found at Buena Vista, where no seasonal changes in its abundance were detected. *P. stuarti* was an inconspicuous species that did not vocalise much, often stayed in dense vegetation, and usually flew at <1.5 m above the ground. SA observed it feeding on *Erythrochiton fallax* (Rutaceae) and *Heliconia subulata* (Heliconiaceae) at heights of up to 1.5 m. During the dry season it was repeatedly seen taking insects from spider webs. This could be a sign of breeding activity, as Poulin *et al.* (1992) and Cotton (2007) found that breeding periods in many hummingbirds are related to peaks in arthropod availability during the dry season.

BUFF-BELLIED HERMIT *Phaethornis subochraceus*
This little-known species of restricted distribution (http://www.natureserve.org/infonatura/) was very common at Buena Vista in December 2007 and September 2008, and uncommon in the Botanical Garden in Santa Cruz in April and October 2008. It showed no obvious changes in abundance between seasons. *P. subochraceus* fed on a wide variety of plant species, among them *Amphilophium crucigerum* (Bignoniaceae), *Erythrochiton fallax* (Rutaceae), *Heliconia subulata* (Heliconiaceae), *Juanulloa* sp. (Solanaceae), *Marsdenia* sp. (Apocynaceae) and *Passiflora coccinea* (Passifloraceae). Usually, it perched low in the herb and shrub layer, but SA also observed the species feeding on epiphytes in the lower canopy, 6 m above ground. During the dry season few flowers were available at Santa Cruz, a possible reason for the low density of *P. subochraceus* at this site. At this season, *P. subochraceus* was observed collecting insects from the vegetation on several occasions. Young (1971) reported that Long-billed Hermit *P. longirostris* is mostly insectivorous during the dry season in Costa Rica, and the same might be true for *P. subochraceus* in Bolivia. At Buena Vista, *P. subochraceus* vocalised both in the dry and rainy seasons, but more noticeably in the latter season when two leks of 4–5 individuals each were found. At Santa Cruz, *P. subochraceus* only vocalised during the rainy season, but no leks were observed. Although these observations are unsystematic, they suggest that *P. subochraceus* breeds in the wet season.

FORK-TAILED WOODNYMPH *Thalurania furcata*
Probably the most widespread hummingbird species in South America (Schuchmann 1999), *T. furcata* was recorded at all study sites, including Corbalán in dpto. Tarija, from which department the species had not previously been reported (Hennessey *et al.* 2003). Here, it showed seasonal changes in abundance, being uncommon in the dry season in May 2008 but very common during the wet season in January 2008. At this time, *Stetsonia coryne*, a large cactus tree was mass flowering, and *T. furcata* took nectar by laterally piercing the flowers. Interestingly, all individuals observed at Corbalán were in immature or female plumage. Possibly this area represents a poor-quality habitat for the species, where due to competition only those individuals unable to occupy high-quality habitats occur. Similar observations were reported by Erwald & Rohwer (1980) for immatures of both sexes of Rufous Hummingbird *Selasphorus rufus*.

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